SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2023
ORGANIZATION AND MANAGEMENT SERIES NO. 187

THE ENERGY CONCEPT OF MONEY

Oleksandr MELNYCHENKO

Department of Finance, Gdansk University of Technology; oleksandr.melnychenko@pg.edu.pl,
ORCID: 0000-0002-7707-7888
The London Academy of Science and Business, UK

Purpose: This paper aims to provide the literature review seeking an answer whether energy can be used as a universal equivalent instead of money.
Methodology: The author conducted a review of available literature and data sources related to the money theory and energy concept of money.
Findings: It was found that the definition of energy as a general equivalent has a contextual and dynamic nature, and this field's consolidation and logical expansion require a conceptual review. In this study, we talk about the basic principles of the energy concept of money: origin, recognition, and circulation. Throughout this paper, we explore key aspects of this new agenda, demonstrating that energy is at the heart of money circulation.
Research limitations: It is suggested three areas for future research: quantifying the stability of energy price in the context of fiat money in dynamics, technological implementation of transactions, and the development of accounting technologies.
Practical implications: Consolidating the available literature and providing suggestions on how money theory can be developed in light of the current energy challenges. The author's approach the energy concept of money from an interdisciplinary perspective, including knowledge of economics, business, accounting, payment systems, law, and philosophy, to reflect on their own experiences. The energy concept of money in this study refers to the use of energy in a broad sense as a universal equivalent, the role of which is played today by money.
Originality: In this paper, the author seek to contribute to a deeper understanding of the energy basis of money by exploring the conceptual and empirical relationship between money, trust, and energy.

Keywords: money; energy; trust; universal equivalent.

Category of the paper: Conceptual paper.

1. Introduction

Modern money circulation is based mainly on trust (Brandl, 2020, p. 545; Ingham, 1996a, p. 18; Ingham, 1996b, p. 507; Ingham, 1998, p. 4). People trust the government by exchanging their time, which will never return, skills and knowledge for money issued by government institutions and guaranteed by them as a means of payment. A state is also responsible for preserving the value of money and its purchasing power (Friedman, 2001; Giannini, 1995, p. 219). People also trust banks and other money circulation participants, which guarantee the preservation of financial resources, their transfer in the appropriate direction. They trust other people, transferring money to them in anticipation of receiving a service or product. From ancient times, the usefulness of money and financial transactions is based on the community of trust, which is social and moral, confirmed by historical facts and archaeological excavations (Baron, Millhauser, 2021). Of course, in the modern world, such confidence is supported by various legal norms, rules, legal consequences for the parties to fulfill their obligations and responsibilities (Burlaka et al., 2019; Kwilinski, Volynets, Berdnik, Holovko, Berzin, 2019; Kharazishvili, Kwilinski, Grishnova, Dzwigol, 2020). However, how many times have people experienced situations where commitments have not been met? From the mundane sale of goods lacking the quality to international financial crises, which led to significant losses for those who, indeed, trusted the other side (Dalevska, Khobta, Kwilinski, Kravchenko, 2019, p. 1842). The Great Depression, the global crisis of 2008, and many local upheavals in different countries led to a decrease in the purchasing power of money and significant economic and social problems for citizens. Moreover, since money is created out of nothing, it can be transformed back to nothing by the institutions that have created it (Galvin, 2020). Awareness of this may cause some people to fear working in exchange for the national currency, especially in regions where governments do not enjoy the popularity and trust of the population.

By paying with a card in the supermarket for purchases, customers believe that the funds placed on their bank account and earned will be debited from this account and transferred to the seller. They are confident that they will be able to take things from the cart home and use them at will. They believe it because none of the financial transaction processes depends on them: customers cannot influence it, standing at the checkout in the supermarket. By touching the card to the payment terminal and waiting for the transaction to be complete, we believe it will succeed. Some people know how a payment transaction works and trust in the successful completion of each stage. In contrast, others have no idea what happens after the payment card touches the terminal and simply believe that the payment will go through. At the same time, the card payment itself is essentially a series of significant and technically complex transactions. The number of factors that may affect its successful completion approaches infinity.

In the case of bilateral relations between, for example, sellers and buyers in legal countries with developed economies, the former are more often fully liable for improper performance of their financial obligations in the form of full compensation for customer losses or otherwise under the law. When it comes to monetary losses of the population at the national or international level due to inflation, no one is actually responsible to those affected by it. Of course, there are tools for indexing earnings and market mechanisms for income growth. Still, these are the existing ways of dealing with the consequences of money value decrease, not a measure of personal responsibility to prevent losses.

On the other hand, money creates a sense of trust in society, which is one of its most important social functions. Let us say that money does not exist and economic relations are built on trust. People would receive goods and services without payment, having only a sense of responsibility to society as a whole and specific people, in particular, to give their knowledge, skills, and time in full also without monetary payment and additional guarantees that their work or goods would be valued in financial terms. However, the level of responsibility as a human personality trait is different for all people. We can hardly imagine today a society in which everyone would have the required responsibility level to support such a system. Therefore, the level of trust between people is different because everyone understands that the responsibility of the other is not ideal. This is also confirmed by various studies (Thielmann, Hilbig, 2015, p. 249), in particular, that the level of trust can change significantly under certain circumstances, so it is not stable (Rahman, Lee, Shabnam, Jayasinghe, 2020, p. 460). "Most people care about collective interests, but they are reluctant to contribute because they fear that other people free ride and their contributions would be exploited and wasted" (Tam, Chan, 2018, p. 183). In such circumstances, we need guarantees, a universal tool, and an equivalent that would guarantee the fulfillment of obligations and equalize the level of trust. Such a tool today is money.

Trust is an integral concept of social cohesion. It is one of the pillars of society. This idea is supported in a number of scientific publications (Bejarano, Gillet, Rodriguez-Lara, 2021; Grossmann et al., 2021; Van Den Akker, van Assen, Van Vugt, Wicherts, 2020), which emphasize that it can be a resource for individual or social development, while its lack can hinder cooperation and contribute to conflict. But can the money be a guarantee of obligation fulfillment and equalize a level of trust? Although we do not seek to answer this question directly, we publish this study in a series of key discussions in the field of money theory and social science research and the growing use of energy-oriented approaches to addressing financial problems.

In its modern sense, money has existed for hundreds and even thousands of years (Davies, 2016); only its forms, recording methods, and types of media change. The essence of cash is realized in its physical form as a means of legal payment in a certain area, and the non-cash form is realized as an accounting system, which registers the records of who owes whom and how much. The so-called fiat money has no value based on the materials from which it is made (such as precious metals or other valuable components), and its use is based solely on trust. It has a number of different disadvantages (Melnychenko, 2021b), which have a significant impact on society, economic relations, the functioning of businesses and households, and states and international associations. Therefore, it is advisable to find a perfect, universal tool that would perform the functions inherent in money yet be devoid of its shortcomings. A possible scenario for improving this social phenomenon is the use of energy as a universal substitute and equivalent in modern economic relations. This hypothesis is not new and is reflected in modern scientific publications. However, it has not been studied conceptually but only indirectly in the form of individual assumptions (Haug, 2020), when assessing energy poverty (Grossmann et al., 2021; Halkos, Gkampoura, 2021; Churchill, Smyth, 2020), the energy of finance (Korol, 2021; Melnychenko, 2021b; Melnychenko, Kwiliński, 2017), energy justice, poverty, and security (Jenkins et al., 2016; Kharazishvili et al., 2021; Pająk, Kvilinskyi, Fasiecka, Miskiewicz, 2017). Samid (2015) also asks the question, "Is money energy?" However, it is not a key question in his study, and therefore the answer to it is not provided directly. According to Douthwaite (Douthwaite, 2012), the decisions on money distribution concerning who, for what, and how much can borrow will be made by those who supply energy to society and not banks. "Money once bought energy. Now energy, or at least an entitlement to it, will actually be money, and energy firms may become the new banks" (Douthwaite, 2012, p. 190).

Therefore, a conceptual overview is now needed to consolidate and expand this research area. The biggest problem of modern money is the decline in its confidence due to a number of inherent flaws. Therefore, it is advisable to continue the search for more perfect universal equivalent to uphold the socio-economic relations given the low level of public confidence in institutions, other people, and financial instruments. Given the current energy fever in which energy needs constantly grow (IEA. Data statistics, 2020), and the struggle for energy sometimes develops into a fight for life (San-Akca, Sever, Yilmaz, 2020; Johnstone, McLeish, 2022; Johnstone, McLeish, 2020), we could seek to answer the question of whether energy, in addition to its inherent and known functions, can also play the role of the general equivalent that money plays today. In this paper, the author seek to contribute to a deeper understanding of the energy basis of money by exploring the conceptual and empirical relationship between money, trust, and energy.

In view of this, this paper has two purposes: first, section 3 provides an overview of modern literature and give examples of the shortcomings of contemporary money from the standpoint of trust, and secondly, section 4 proposes new uses of energy as general equivalent replacing modern money. Thus, a conceptual overview and research agenda are proposed while consolidating the available literature and providing suggestions on how money theory can be developed in light of the current energy challenges. The author's approach the energy concept of money from an interdisciplinary perspective, including knowledge of economics, business, accounting, payment systems, law, and philosophy, to reflect on their own experiences. The energy concept of money in this study refers to the use of energy in a broad sense as a universal equivalent, the role of which is played today by money.

This study is intended to provide an overview of some major economic aspects of the functioning of energy as a general equivalent. The task we set ourselves is challenging due to the novelty and interdisciplinary of the topic and the large number and variety of literature covering it. Accordingly, some issues are only partially addressed and require further discussion, elaboration, and in-depth research. The author made a snowballing review of predominantly English-language literature on this topic by an extensive direct and reverse search. It was found more than 100 relevant links and peer-reviewed publications from the SCOPUS, Web of Science, and ScienceDirect scientific research databases were included that we used to support our idea. The author has used such keywords as trust, energy, money, money theory, energy theory of value, functions of money, payment, energy poverty, etc. The literature review focused primarily on the 1974 and 2022 literature to capture the latest trends and advances in specified areas for these keywords.

2. Research method of the systematic literature review

The methodology adopted in this section involves a literature review underpinning the dimensions of the problem investigated and the elements that need to be tested via primary data analysis.

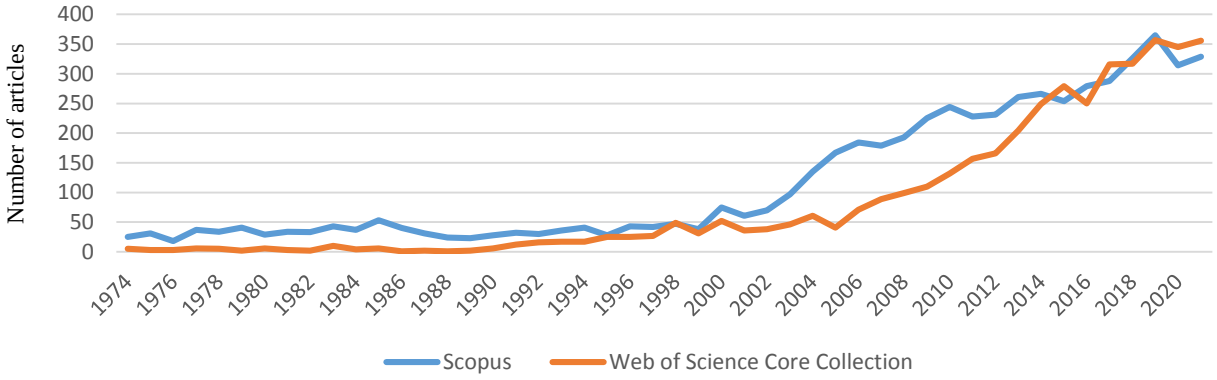
We use the three-step procedure conforming to the methodological approach of systematic literature review, which is "a powerful technique in social science research, which is about systematically locating, evaluating and synthesising all available information to an effect or a topic area" (Tsigdinos, Tzouras, Bakogiannis, Kepaptsoglou, Nikitas, 2022; Davis, Mengersen, Bennett et al., 2014). This approach showed its efficiency in many scientific papers such as (Tsigdinos, Tzouras, Bakogiannis, Kepaptsoglou, Nikitas, 2022; Bask, Rajahonka, 2017, p. 565; Wray, 2004; Oliveira, Bandeira, Vasconcelos, Schmitz, D'Agosto, 2017) and consists of the following steps: (1) planning, which identifies the need for the systematic review, defines the sources and procedures for literature searching, and contains a review protocol;

(2) the review process realization implementing the defined criteria, identification, selection, inclusion, and evaluation of the selected papers. At the end of this step is data extraction and its synthesis; (3) presentation and dissemination stage, which includes preparing the reports and presenting the results.

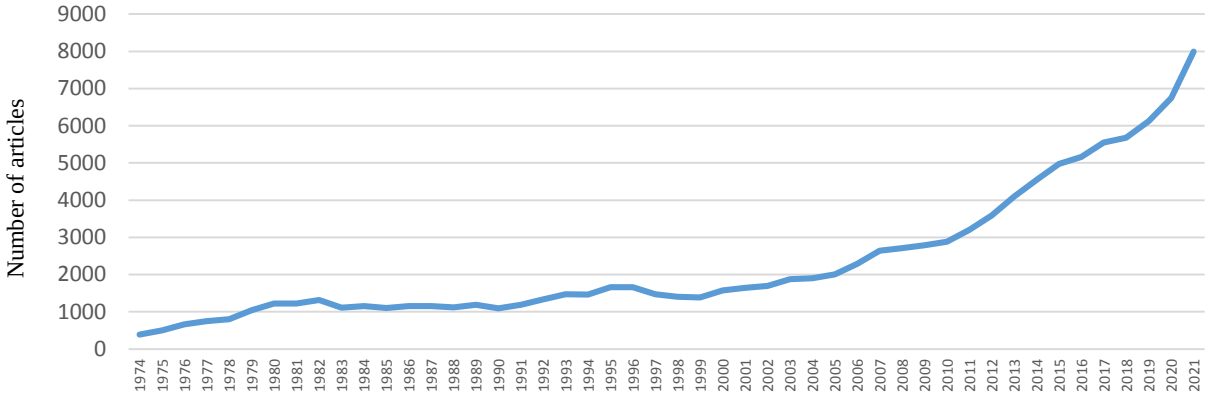
Hence, we made the research plan, which included aim and questions, keywords, and a set of inclusion and exclusion criteria. The literature review's purpose was to identify the perspectives in the scientific papers related to the energy concept of money and investigate research to answer the question of whether can energy be used as a universal equivalent instead of money. We assembled keywords, namely, "energy" "money", "energy money", "money theory", "energy money theory", "energy theory of value" and limit their to subject area related to economics, business, management, finance and accounting, because the most energy studies related expectable to other scientific areas like engineering, environmental science, etc. The following databases were used for the development of the protocol of the review: SCOPUS, Web of Science (WoS), and ScienceDirect according to the recommendation of Nord and Nord (Nord, Nord, 1995, p. 35), who suggest using more than two databases to ensure the identification of a better diversity of papers.

The inclusion criteria were defined as academic peer-reviewed journal papers written in English that are in line to the research objectives. Furthermore, the papers examined were published after 1974, when the issue of energy and money was started complex, dynamically, and rapidly investigate. The results of a bibliometric analysis of the changes dynamics in the number of publications on energy and money in the Scopus and WoS databases show its gradual growth. In 2003, the number of publications on energy and money indexed by the SCOPUS database increased significantly to 97 from 70 in 2002. A similar situation is observed in 2006 with publications on the problem of energy and money in the WoS database. These trends are related to the historical milestones and energy crisis: 1973 oil crisis (Alpanda, Peralta-Alva, 2010, p. 830), 2003-2008 oil price boom (Casertano, 2013, p. 213). In general, energy consumption from 1995 to 2015 grew exponentially, and in 2021-2022, energy has become a weapon, especially in relations with Russia (Stegen, 2011, p. 6508). That is why, to ensure the timeliness of the selected texts and based on the mentioned search assumptions the period from 2004 to 2022 was set.

In step 2, the search was performed for article titles, abstracts, and keywords. The search was performed in June 2022. No time restrictions were applied to the search in the first stage. Initially, the search returned a total of 133 699 articles including journal articles and conference proceedings found in Scopus, Web of Science, and ScienceDirect databases by keywords "energy" AND "money" (Figure 1).



a)

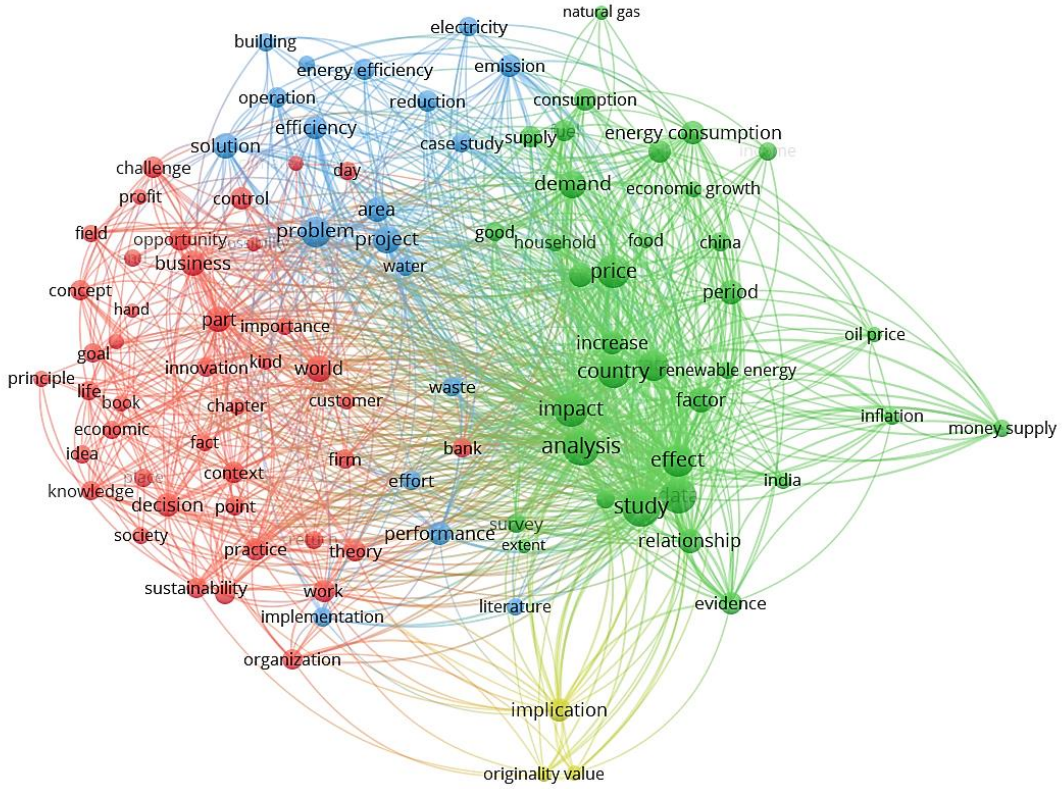


b)

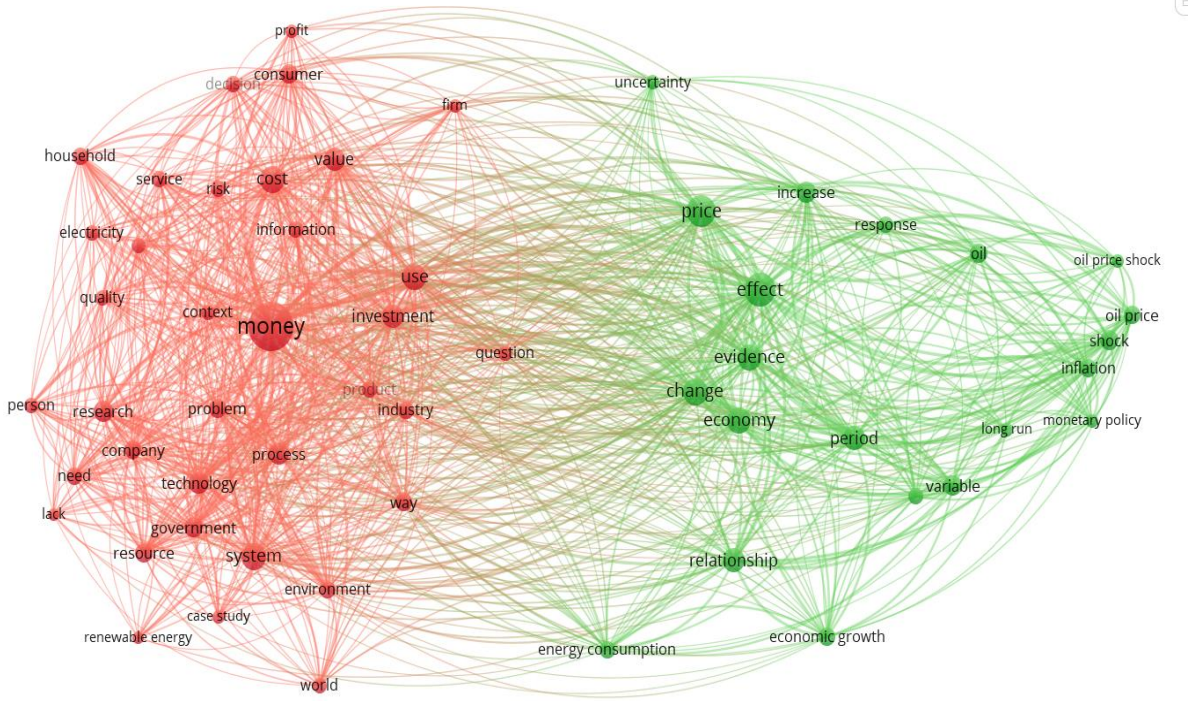
Figure 1. Number of articles in the a) Scopus, WoS and b) ScienceDirect databases on energy and money, 1974-2021.

Source: Compiled by the author on the basis of the Scopus, Web of Science, and ScienceDirect databases.

The bibliometric analyses results conducted by VOSviewer tools show the relationship of the energy and money with a number of economic categories (Fig. 2), in particular, such as price, business, cost, good, and demand, which are closely related.



a) Network visualization based on the Scopus



b) Network visualization based on the Web of Science

Figure 2. Network visualization of the connection of “energy” AND "money" limited to English; Subject areas (categories) Business, Management, Accounting, Economics, Econometrics, and Finance.

Sources: developed by the author based on the Scopus and Web of Science databases.

To help ensure the quality of the pool of identified papers “Grey literature” and conference proceedings, books, technical reports and webpages were excluded from the set. The search was conducted using Scopus, Web of Science, and ScienceDirect presents the number of papers found for each combination of keywords. It was also made a filter that limits articles language to English because the phrases of the energy concept of money has different translations in various languages that do not fully reflect its proper understanding.

The search for journal papers written between 2004 and 2022 limited to English; Subject areas (categories) Business, Management, Accounting, Economics, Finance; Article document type, Final publication stage, Journal source type by keywords "energy money", "money theory", and "theory of value”, returned 1546 papers. Then the search was performed by keywords "energy money theory", “energy theory of value”, “energy” AND "money theory", and “energy” AND “theory of value” and limited to English; Subject areas (categories) Business, Management, Accounting, Economics, Finance; Article document type, Final publication stage, Journal source type. It returned 232 papers. These passed a title and abstract screening and were ‘eye-balled’ for consistency and precision of the keyword search purposes, also duplicates were removed. The final set of relevant papers included only 94. The full text of these initially screened articles was then compared to the study’s research focus. This led to a review pool consisting of 86 articles, which were re-read, reviewed, categorised, and analysed. This literature selection procedure is illustrated via a PRISMA diagram (see Fig. 3) that ensures transparent and complete reporting of the Systematic Literature Review process. Therefore this systematic literature review develops strong foundations for future research in the chosen area.

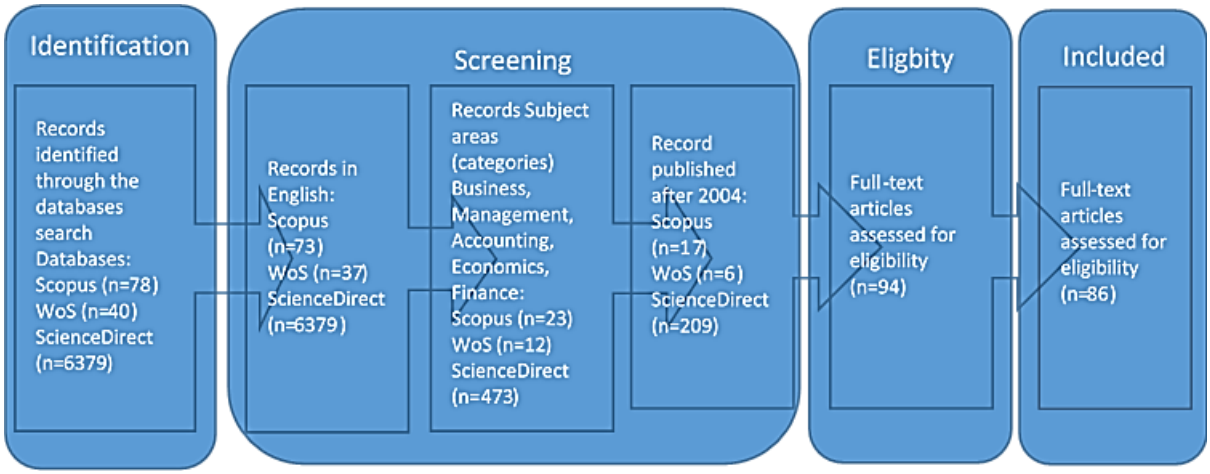


Figure 3. PRISMA workflow and number of collected papers in each step.

Source: http://prisma-statement.org/PRISMAStatement/Checklist

In stage 3 (presentation and dissemination), the work focused on presenting findings related to identifying the concepts underpinning the energy concept of money. Particularly, a synthesis process was undertaken, highlighting and combining different elements to formulate the concept in question. At this stage, other publications on the topic were also integrated as additional supporting literature evidence to better comprehend the issue and elaborate better

results. The total number of reviewed publications was 166. Based on the bibliometric analysis and literature research we are presenting the knowledge review in the next paragraphs.

3. The Problem of Trust

Galvin (Galvin, 2020), answering the question of what money is and analyzing different approaches to its interpretation, explains the artificial nature of the origin of money. It is, in essence, "a relationship of obligation and entitlement between a debtor and creditor. It is thereby a basic social phenomenon grounded in power relationships that are backed up by the state with its rules, institutions, and coercive apparatus. Most money today is created out of nothing by the commercial banking system as loans to customers". "Banks do not transfer real resources, but rather create money and purchasing power" (Li, Wang, 2020; Werner, 2014, p. 5; Werner, 2016, p. 363; Eeghen, 2021; Azarenkova, Samorodov, Melnychenko, 2014, p. 360). Indeed, money does not exist in nature, and its appearance is the result of human activity. Its recognition as a general equivalent is based on the rules and coercion set by the state. This thesis also underlies the statement of the European Central Bank (ECB), which is developing the digital euro project, stating that "just like cash, a digital euro would be a direct claim on the central bank and would therefore have no risk – no liquidity risk, no credit risk, no market risk" (Preparing for the euro's digital future…; Kwilinski, Vyshnevskyi, Dzwigol, 2020). The ECB will be the debtor, the ower, to whom each person can clmages for the single European currency. However, what can such requirements look like in practice? If, under the gold standard, a banknote holder could apply to a bank to exchange paper money for gold, to which asset can the creditor exchange the central bank's liabilities? To the same money with the same obligations and real assets such a person will not receive due to the credit nature of money.

Therefore, the level of trust in money directly depends on trust in the government and other institutions involved in their creation. "But as the 2008 crash demonstrated, the institutions in which we place our faith are liable to let us down" (Haug, 2020). Moreover, in Europe, trust in existing elected democratic institutions is fading (Grossmann et al., 2021; Valdez, Kluge, Ziefle, 2018, p. 133), but it is a vital component of reforms (Caferra, Colasante, Morone, 2021). As Greenberg notes, "the major reason why trust is an issue for society is that public concerns about risk appear to have intensified" (Greenberg, 2014, p. 152). Distrust in money also grows in an environment where society repeatedly faces the problem of preserving the value of the local currency contrary to the assurances and obligations of relevant authorities. Thus, in the countries of Eastern Europe in recent decades, there have been several economic crises, leading to significant losses of savings and current solvency problems (Hofmarcher, 2021; Rodriguez-Alvarez, Llorca, Jamasb, 2021; Halkos, Gkampoura, 2021; Karpinska,

Śmiech, 2020; Kostyrko, Kosova, Kostyrko, Zaitseva, Melnychenko, 2021; Vatamanyuk-Zelinska, Melnychenko, 2020, p. 11). On the other hand, confidence in the euro, particularly cash, remains high in the European Union, which is not surprising given the low inflation rate in the eurozone of 0.7% in 2020 (HICP - inflation rate). This is evidenced by the fact that about three of the four banknotes stored in Germany are under the so-called mattress or in a safe (Beermann, 2020). Despite all the advantages of cash (The Eurosystem cash strategy and the role of cash), the share of payments made by non-cash methods is growing in the euro area for various reasons (Card payments in Europe…; Cabello, 2020, p. 25). However, there is no evidence that this increase is due to increased confidence in non-cash forms of payment and decreased trust in cash. On the contrary, distrust of cash transactions displaces and restricts their use (for example, to pay large sums of money) to increase control over those transactions where there may be doubts about their legitimacy and confidence in them and entities that carry out such operations. After all, if there were no doubts about the honesty and integrity of the participants in financial transactions, then there would be no need for measures to combat money laundering, terrorist financing, and so on.

In general, we can talk about trust based on its two pillars: 1) justice and 2) confidence, which are subjective and depend more on the experiences, feelings, and cognitive limitations of people who assess the level of trust (Melnychenko, 2020).

Let us take a closer look at each of these pillars in terms of trust in the modern monetary system in light of the possibility of using energy as a general equivalent.

1) The distribution of goods, not money, is the primary concern of any society that seeks to be fair. An example of this in retrospect is an influential study in the field of archeology (D'Altroy, Earle, 1985, p. 188), which shows that the leaders of ancient peoples strengthened power over other elites through control over the production and distribution of rare and valuable items, and through control over necessities for ordinary people to prove themselves as a source of legitimate power. Today, the distribution of money is more convenient (Buchanan, Roberts, 2021) because the problems with logistics in the distribution process are not as significant as with, for example, necessities; money does not require high costs to be delivered or stored; it can be distributed conveniently among recipients. However, according to Sovacool (Sovacool, 2014, p. 3), it is energy that must be distributed in the first place to achieve a sense of justice, which, in addition to being a commodity, is also a rare and precious resource.
2) Society's confidence in the future is based on the belief that the existing system and the very life of man will continue in a state not worse than today. And "money and the desire for physical well-being is one of the most fundamental human motivators" (Franzen, Mader, 2022). In this case, well-being directly depends on energy because energy is one of the key elements of a modern economy and the functioning of an entire civilization. Without energy, neither living organisms can function, particularly people, whose work is the basis of economic relations, nor machines, which perform most types

of work in modern conditions. Without energy, the movement of capital underlying the economy, the growth of which depends on energy prices, is also not possible (Ayres et al., 22013,, p. 9). After all, money production itself requires a significant amount of energy to extract and process all components of cash (for example, to produce one US dollar banknote, 97 850 MWh is needed for printing, which is equal to 0,35 million GJ, and to manufacture pulp – 0,45 million GJ) (Ahlers et al., 2010), the operation of servers, and other payment infrastructure for non-cash money (Melnychenko, 2021a). In turn, energy security is the reliable supply of energy at reasonable prices to support the economy, industry (Dorian, Franssen, Simbeck, 2006, p. 1984; Vivoda, 2010, p. 5285), and social order. Accordingly, there is a possibility of being in energy danger, energy poor (Churchill, Smyth, 2020), or energy vulnerable (Middlemiss, Gillard, 2015, p. 146), which can lead to violation and destruction of the existing order and life in both biological and socio-economic sense. According to Middlemiss and Gillard (Middlemiss, Gillard, 2015, p. 147), this problem consists of six key issues: housing quality, energy costs and supplies, household income stability, rental housing, social relations inside and outside households, and the state of health. These problems are directly related to financial vulnerability, as each of them is directly related to lack of funds, financial security (Melnychenko, 2020; Tkachenko, Kwilinski, Korystin, Svyrydiuk, Tkachenko, 2019, p. 376), and financial pillars (Thacker, 2013, p. 205), on which such security depends. Therefore, we can say that energy and money are closely related and interdependent.

What motivates society to trust the modern form of money and money circulation?

Modern research has revealed two aspects of trust: 1) based on the competence of agents, i.e., trust in knowledge and experience; and 2) based on the decency of agents, i.e., belief in the honesty and transparency of agents (Gordon, Brunson, Shindler, 2014, p. 579; Liu, Bouman, Perlaviciute, Steg, 2020; Terwel, Harinck, Ellemers, Daamen, 2009, p. 1130; Mayer, Davis, Schoorman, 1995, p. 709; Siegrist, Earle, Gutscher, 2003, p. 705; Poortinga, Pidgeon, 2003, p. 961). In some cases, trust built on competence prevails over trust built on values (Greenberg, 2015, p. 152). Each aspect of trust is based on information flows, which can also distort reality and manipulate people's minds in addition to any positive impact. Thus, achievements in marketing (Arasu, Seelan, Thamaraiselvan, 2020; Jacobson, Gruzd, Hernández-García, 2020; Salo, 2017, p. 115), social engineering (Hatfield, 2018, p. 104; Li, Wang, Ni, 2020, p. 47; Mouton, Leenen, Venter, 2016, p. 186; Prentice, Paluck, 2020, p. 13), as well as consumer experience and the vital need to purchase necessities show that the solution and trust in anything are sometimes only an illusion because modern virtual communities can form and change human perceptions and actions (Lee, Lee, Oh, 2015, p. 110; Sedera, Lokuge, Atapattu, Gretzel, 2017, p. 831). The spread and participation of society in various virtual communities (as of 2021, Facebook has more than 1.8 billion active users daily, i.e., 39% of global Internet users) (10 Facebook statistics every marketer should know in 2021; Global digital population as of

January 2021) influence human behavior according to Kelman's theory (Kelman, 1958, p. 56), which is also easier than ever because the compliance, internalization, and identification that shape human conduct are much faster and involve a much larger audience. Fear of loss (Przybylski, Murayama, De Haan, Gladwell, 2013, p. 1841) and other cognitive biases (Thaler, 2015) affect the behavior of people who, by their own actions, see their own decisions, which are modified by such cognitive biases and external referents (Wang, Meister, Gray, 2013, p. 299), as well as under previous life experience (Stamos, Altsitsiadis, Dewitte, 2019, p. 20). An outreach increases trust and helps build working relationships in society (Greenberg, 2014, p. 152). Thus, in addition to the positive aspects, trust can promote exploitation and predation, allow unethical conduct and fraud (Yip, Schweitzer, 2016, p. 2016). Accordingly, trust in money is formed in society based on information available to end-users and socio-economic conditions rather than objective reality, the essence of which is the need to own energy, not capital, to prolong life and further functioning of the economy and social order in general. At the same time, "trust is inevitably accompanied by a certain degree of risk and vulnerability" (De Filippi, Mannan, 2020). In this case, since a person decides to trust or not to trust, then in case of failure, he (or she) assumes part of the blame and is unable to demand compensation from the other party for losses (De Filippi, Mannan, 2020). This is the basis of the monetary policy: the population trusts the government, and when money loses its value, the people have no right to demand more than the expectation of indexation; they also have no right to demand full compensation for financial losses. Therefore, the modern monetary system is not fair and requires changes to be better. Moreover, there is evidence that society will appreciate any means of exchange that can be used to enter into transactions and complete transactions if people need to participate in personal, unreliable exchanges (Borgonovo, Caselli, Cillo, Masciandaro, Rabitti, 2021). In other words, for society, the use of energy as a general equivalent, a universal commodity, will not be a problem and will not lead to any difficulties.

4. Problems of Financial Services

Another disadvantage of using money as a universal equivalent is the cost because 97% of social costs for servicing payments (Schmiedel, Kostova, Ruttenberg, 2012; Melnychenko, 2013) are borne by trade facilities and banks (Przenajkowska, Polasik, 2018, p. 283; How much…; 2012). One-third to two-fifths of the large US commercial banks' income comes from payment services (Radecki, 1999, p. 53). Some costs are associated with providing energy to the payment infrastructure and creating and maintaining the means of payment. Most emissions come from the supply chain of financial services and energy, which is used for the production, transportation, and utilisation of cash, equipment for servicing payments, mining of cryptocurrencies, and ensuring their circulation (Melnychenko, 2021a).

And the ECB's confidence that "the energy needed by the settlement infrastructure we used is negligible compared with the energy consumption and environmental footprint of crypto-assets such as bitcoin, which uses more electricity than Greece or Portugal alone" (Preparing for the euro's digital future…) does not appear convincing due to, for example, the significant energy costs of servicing the payments borne by retailers (Melnychenko, 2021a). Therefore, energy is primary also in money circulation; that is why Haug (2020) suggests that "in the future, we could, for example, imagine all money being linked to energy, where the money transferred into your bank account would actually be in the form of energy transferred into a battery bank". The author shows the cost of energy required to store the smallest currency electronically: "the absolute smallest money unit is directly linked to the Planck scale and the Planck constant" (Haug, 2020). Although the categorical apparatus of his article is not perfect because it does not distinguish between the concepts of electronic money and non-cash money (Samorodov, Melnychenko, Koshcheeva, 2014, p. 204), it is noteworthy that any currency has its energy value. This hypothesis is supported in the work of Sun et al. (Sun, Qiu, Zhang, Meng, Yin, Dong, 2020), who propose the concept of an energy bank system "using a sharing economy model". The author considers "money is electrical energy", and the object of storage in such a bank will be "energy currency" in kilowatt-hours. The author's simulation results show that such a bank provides higher economic benefits and social welfare. Money can also be considered a source of energy in a broad sense, as discussed in (Korol, 2021; Melnychenko, 2021b; Melnychenko, Kwiliński, 2017, p. 67; Zawadzka, Strzelecka, Szafraniec-Siluta, 2021), and the financial energy of the enterprise can be considered its general financial position. Thanks to the energy of finance, it is possible to increase the capabilities of organizations, their ability to perform their functions. The question raised in this paper is whether energy can be used as a general equivalent instead of money in its current sense and manifestation. For an unambiguous answer, we should first turn to the essence of money and model the possibility of using energy where money today performs its functions and ensures the functioning of society.

The most important problem addressed by the general equivalent in the form of money is the absence of a double coincidence of desires, due to which barter exchange is impossible, and debt obligations issued by households will not circulate in equilibrium (Williamson, 2003, p. 475). Under the double coincidence of desires in this study, we mean socio-economic relations in which one party owns a product that it can exchange with the other for items of the results of its professional activity or obtain in another way as a result of previous events (purchases, exchanges, etc.). The absence of a double coincidence of desires means that one of the parties to the exchange does not need what the other side has to offer it. From this point of view, energy (like modern money) can play the role of the general equivalent. On the one hand, each person must ensure their livelihood; on the other, it can be exchanged as a universal commodity. As noted above, energy is the basis of money, not vice versa.

Another problem associated with the use of cash or non-cash is access to financial services where the organization of their provision is related to difficulties in financing, access to the Internet, or other technical problems. Therefore, in some countries, where most of the population does not have access to financial services, various methods are used to implement economic activity and money circulation, for example, mobile money (Lashitew, van Tulder, Liasse, 2019, p. 1201; Munyegera, Matsumoto, 2016, p. 127; Koibichuk, Ostrovska, Kashiyeva, 2021, p. 253; Pająk, Kamińska, Kvilinskyi, 2016, p. 208). On the other hand, such a society has access to electricity, as mobile phones need to be charged for such money to function. For developing countries, energy, in general, is a major factor in the aggregate consumer price index (Figueroa, Molière, Pegels, Never, Kutzner, 2019, p. 228); it is a key factor of living standards (Karekezi, Majoro, 2002, p. 1022). Thus, and in this way of organizing money circulation, energy is the basis. Although it is not necessary to have access to electricity in the case of cash (Hendrickson, Luther, 2021), thermal, mechanical, and another energy is required for its production and distribution.

Like any idea, the ability to use energy as money is not without its drawbacks. And we realise that energy markets are complex, and physical energy delivery requires expensive infrastructure and complicated processes (Kuzior, Kwilinski, Hroznyi, 2021; Lyulyov et al., 2021a; Lyulyov et al., 2021b). In this case, as noted by Ante et al. (2021), "the increasing share of renewable energy and its volatile supply of power only serve to amplify this complexity".

In any case, in order to conclude whether energy can be used as money or its substitute, it is necessary to turn first to the functions of money and explore the practical feasibility of financial transactions using energy.

5. Money Functions in Energy

Among economists, three main functions of money have been considered for some time: the standard of value and unit of account, the medium of exchange, the store of value. We will consider each of them below in the context of our study.

For a certain asset to be considered money, it must be accepted by participants on the market as a means of exchange, i.e., when such an asset is used in trade, but not for direct consumption or production but further exchange for other goods. However, in some cases, the money itself may lose this function as in the case of high stakes in games, when players show contempt for money as a means of exchange (Lears, 1995, p. 10). On the other hand, in the modern literature, there is evidence that in the electricity market, electricity is traded as a commodity (Lekshmi, et al., 2018, p. 689), i.e., energy can be used as a means of exchange, not for further use in production but a further exchange. Like finance, energy can be viewed in terms of effects:

efforts to acquire it and final products manufactured with its direct participation (Baron, Millhauser, 2021).

Levulytė and Šapkauskienė recall that "for a financial instrument to act as a measure of value, the buyer must be able to understand the value by seeing the specified price of the good and be able to assess whether it corresponds to the market price or not. Moreover, they can immediately compare the store price with the implied market price and assess whether the item is relatively cheap or expensive" (Levulytė, Šapkauskienė, 2021, p. 46). Exploring the basics and proposals for environmental macroeconomic policy, Svartzman et al. define money as one of the most fundamental institutions that shape social relations. According to the authors, it creates proportionality and comparability between different goods and services, creating and legitimizing value (Svartzman, Dron, Espagne, 2019, p. 111; Aglietta, Ponsot, Ould-Ammed, 2016). However, with the complication of societies, the authors continue, money has made us forget about the fundamental role of energy and material flows. According to these researchers, money is not the basis of everything – energy and materials are. And no matter how the world changes, there are and will be problems that cannot be solved with money but can be resolved with energy, effort, and better monetary order. Therefore, the search for ecological endogenous money is needed. Such a tool could be "green" energy in the context of our study and the development of research by Svartzman et al. (Svartzman, Dron, Espagne, 2019, p. 110).

"In order to be considered as money, an asset should be able to store value", i.e., "to be successful, an asset preferably should provide its user with some level of security" (Levulytė, Šapkauskienė2021, p. 46). Accordingly, the lower the level of security provided by money, the less it performs this function and the poorer its user or owner becomes. Thus, despite the amount, money may not perform its fundamental function under the influence of macroeconomic, political, financial, technological, or other factors that lead to the loss of money value and ability to provide financial security for the user (Lakhno et al., 2018, p. 1807). Instead, energy poverty is caused by "energy deprivation and restricted access to energy services – including transport and mobility, and the resulting restriction of opportunities to participate in society" (Ambrosio-Albala et al., 2020). The availability of energy and its sufficient amount can ensure the safe existence of society. At the same time, the value of energy and the level of energy poverty do not depend on the factors that create financial poverty. Thus, becoming poor with sufficient access to energy and energy services is virtually impossible in today's world, unlike economic poverty. Therefore, energy as an asset can more reliably perform the function of saving value. Moreover, energy is not a credit in its essence; the return and acceptance of energy are "in fact". Moreover, in addition to supply and demand, its value is its actual value, which is determined by the number of materials for its extraction. Its use is also associated with actual processes (Dementyev, 2020). Thus, energy as money or "post-money" would have, in addition to the value in terms of goods and services, also the intrinsic value that modern money has long lost, so we can only believe in its value, as discussed

above. Moreover, unlike money, energy does not lose its value: 1 KJ of energy will always have this value.

Deepening the idea of the possibility of using energy as money and exploring its practical use in this role, it is worth paying attention to a currency as a narrower concept that characterizes money circulation. It is "a medium of exchange with a unique denomination, that relates to a unique standard of value, but which might take several forms as a means of payment (notes, coins, etc.)" (Larue, 2020; Tobin, 2008). Like any system of value assets, the system of energy-money circulation could probably use the joule as a currency divided into smaller microjoules, millijoules, and others. Of course, you can use invented names, the use of which, however, would take time to be accepted in society. Although such an example is successfully implemented today, the smallest bitcoin unit is satoshi, which is 0,00000001 bitcoin (10-8), also known as 1 SB. It did not take centuries for this currency to be recognized, but it is used successfully in a significant digital asset market.

Each medium of exchange is also linked to a payment mechanism (Borgonovo, Caselli, Cillo, Masciandaro, Rabitti, 2021), so attention should be paid to this technical and practical aspect of using energy as a substitute for money or a general equivalent. Ante et al. conducted a substantial bibliometric analysis of the intersection of blockchain and energy (Ante, Steinmetz, Fiedler, 2021), showing that the widespread use of blockchain technology in today's energy sector is impossible. Although the authors did not consider the use of energy as a general equivalent in their work and did not find research in this area in the modern scientific literature, they concluded that "blockchain technology provides an immutable ledger for secure value transactions in a network" (Ante, Steinmetz, Fiedler, 2021). Furthermore, and most importantly, this technology does not focus on the exchange of money in the modern sense but on the exchange of values, which is also energy, because it has all the characteristics inherent in the actual values, assets, or resources. Therefore, the mechanism that could ensure the accounting of energy turnover as a general equivalent can be implemented based on blockchain.

Table 1.
Theories of the origin of money

Source	The money theory	Contribution	The energy impact
Smith, 1902; Marx, 1911	Labor theory	The essence of which is that money arose in the process of exchange, which in turn arose as a result of the division of labor	The use of energy has increased significantly in the last century, and the added value that is created with the help of energy has also increased significantly. It substitutes and complements "the labor of humans and other animals to multiply overall throughput", "energy is what saves labor" (Singh, 1999, p. 754)

Cont. Table 1.

Wray, 2004	Credit theory	Money does not come from the commodity exchange but from credit, and that the currency issued by the state is simply required for public debt	In modern energy markets, capacity credits are widely used to overcome peak energy consumption, which indicates the possibility of using energy as capital along with financial capital (Sovacool, 2014, p. 5; Stamos, Altsitsiadis, Dewitte, 2019, p. 21)
Weber, 1978	"Chartalist" theory	Considers money primarily as a product of the state and its origin – in institutional accounting and debt payment	State control in the field of energy significantly affects its development (Tam, Chan, 2018)
Friedman, 1956	Quantitative theory	The long-term inflation is directly proportional to the long-term growth of money supply	With very low variability in inflation, it is difficult to find any connection between inflation and money supply growth (Svartzman, Dron, Espagne, 2019, p. 111)
Keynes, 1930	The general theory	The level of prices in the economy is determined by supply and demand and prices for individual goods are individual	"Demand and supply are measured from the consumption and production of energies" (Rakpho, Yamaka, 2009, p. 1132)
Sasakura, 2021	Macroeconomic theory	Prices are determined by supply and demand in the short term	
Caldentey, 2015	Neoclassical theory	In the economy of private property, there is a vector of prices compatible with all existing resources	"Energy inflation is correlated with headline inflation not only at a short-term horizon but also at lower frequencies" (Giri, 2021)

Classical and modern scientific literature identifies several concepts of the origin of money and its theories (table 1) each of which, in our opinion, does not contradict the possibility of using energy as a general equivalent. In this context, the energy theory of money would also not be meaningless, the essence of which could be that money arises from the amount of energy spent on resource production, and its value is determined by the influence of supply and demand for energy in the relevant energy markets.

6. Direct Transfer of Assets

Modern money also performs a communicative function to transfer information about past exchanges of assets that people use to purchase goods and services, the buyer, seller, and subsequent transfer of information to other agents with whom the seller may interact in the future (Townsend, 1989, p. 1326; Lacker, Weinberg, 2003, p. 384). In this case, the circulation of energy as a universal equivalent may have one significant and fundamental difference to money circulation, namely, the transfer of assets could occur directly, i.e., payment and calculation could coincide in contrast to modern payment systems when the actual calculation is made much later – after payment organizations and banks carry out corresponding operations, so-called clearing (Güntzer, Jungnickel, Leclerc, 1998, p. 213). This principle of calculation is

given by supporters of cryptocurrencies or smart contracts based on blockchain technology (De Filippi, Mannan, 2020; Eenmaa-Dimitrieva, Schmidt-Kessen, 2019, p. 70; Melnychenko, Hartinger, 2017, p. 29; Bogachov, Kwilinski, Miethlich, Bartosova, Gurnak, 2020, p. 488; Kuzior, Kwilinski, Tkachenko, 2019, p. 1358) as an advantage of its use. Therefore, energy, performing the functions of money, in this sense, may have the best characteristics of modern digital assets; however, without inherent defects. Combining energy and blockchain to organize payment turnover can also be promising because the example of the operation of payment systems based on blockchain has proven its effectiveness on the model of cryptocurrencies. However, this payment method is not gaining popularity in those circles where there is not enough trust in such assets as a cryptocurrency due to misunderstanding of their nature, lack of guarantees and collateral, non-transparency of pricing, and lack of intrinsic value. For example, in retail, which is essential for society, this type of payment has not gained popularity for these reasons. And blockchain technology itself does not look like a "savior" of trust in society today, despite all the hopes placed on it. And although some authors conclude that the value of the cryptocurrency bitcoin is related to the value of energy (O'Dwyer, Malone, 2014, p. 281), there is no evidence that its value is in energy. Along with energy-based ones, there are also "stablecoins are digital currencies that peg to non-volatile values" (Ante, Fiedler, Strehle, 2021), which, however, cannot be considered cryptocurrency, but rather e-money, especially if they are provided with fiat money (Singh, 1999, p. 758).

7. Discussion

Modern research confirms that "money is a tangible or electronic item universally accepted as a medium of payment in immediate or deferred time for goods, assets, and services in a given economy or socio-cultural environment" (Cunha, Melo, Sebastião, 2021).

Demonstration of the primacy of energy in money circulation is consistent with research into energy poverty in the sense that energy is the basis of life in general and the socio-communicative needs of people. Thus, when measuring energy poverty, the authors (Nussbaumer, Bazilian, Modi, 2012, p. 233) include in the index of multidimensional energy poverty, in addition to thermal energy for space heating, cooking (which is also, incidentally, a source of energy for humans), and electricity for the operation of various devices and equipment. Property rights that arise in connection with the acquisition of equipment, products that use energy and/or are its source. The authors combine and equate the financial capabilities of households to the energy component.

In modern financial systems, a unique defining feature of banks is their issuance of obligations on payment instruments; banks have the property by which their obligations serve as a medium of exchange. The idea of issuing energy obligations in the energy concept of

money is consistent with the aforementioned study by Douthwaite (Douthwaite, 2012, p. 190) that energy can be money and energy companies can become new banks.

The "payment economy" (Kahn, Roberds, 2009, p. 4; Lacker, Weinberg, 2003, p. 383) is based on exchange systems financed by private and/or public liabilities and institutions that facilitate settlements and settlements under these instruments. "The payments system is the network of private and public intermediation arrangements through which transactions take place" (Williamson, 2003, p. 478). And these agreements can be implemented on the basis of energy turnover because, in the modern literature, there is a significant amount of evidence that energy is traded as a commodity (Lekshmi et al., 2018, p. 689).

Moreover, the energy concept of money and the real value of energy money will not contradict the concept of debt, credit, and endogenous money, which is confirmed by Lagoarde-Segot (Lagoarde-Segot, 2020).

Our study of the possibility of using energy as a general equivalent and money is consistent with Jevons (Jevons, 1875), who lists the characteristics that a resource has to have to be considered money. Usefulness and cost, portability, recognisability, divisibility, indestructibility, value stability, and homogeneity are among them. Each of these characteristics is significant and, to a greater or lesser extent, can be applied to energy; to a much greater extent, in our opinion, than to Mayan salt cakes, which were used as money, according to archeologists (McKillop, 2021).

8. Conclusions and Further Research

We carried out a systematic review of the energy concept of money in the scientific literature in the peer-reviewed publications from the ScienceDirect, Scopus and Web of Science scientific research databases, seeking an answer whether energy can be used as a universal equivalent instead of money. Our review against the framework of trust, energy, and universal equivalent in economic relations in the condition of the absence of a double coincidence of desires has revealed several issues about each of them in isolation and their interaction that have been attended in the extant literature. Based on the synthesis of those findings, we found that there is a diversity in the extant literature on the examination and conceptualization of energy use as money. However, we further found this diversity in the extant literature is a desirable diversity. It is needed to own energy in a broad sense, not capital, to prolong a life and further functioning of the economy and social order in general.

As other scientific publications show, modern money arose as a result of the evolutionary development of society. Still, it is not perfect from different points of view, particularly from the standpoint of its value because it has no intrinsic value. The trust to it as a measure of value, a standard of payment, unit of account, and means of storage is conditional and proportional to

its issuers' confidence. This is due to the credit nature of money and the inability to obtain real values from the debtor in the person of the issuer, namely, the state or bank. The imperfection of modern money is also due to its technical shortcomings. The essence is that money circulation is based on technical and technological systems, trust in which can be not unreasonably different, given the experience of users, failures, fraud, and error.

Through this review, we attempted to attend to the four broader objectives. First, we tried to study a conceptual framework of trust in the context of the modern monetary system that allowed us to organize and synthesize the existing trust in the literature of the modern monetary system. Second, through this synthesis, we have attempted to elucidate how the extant literature has concentrated on the contextual peculiarities of energy use as a universal equivalent. Third, by elucidating them, we have also tried to bring findings from various studies together in order to produce a better understating of the money function and money theories for using energy as a universal equivalent. Finally, we have also attempted to explain why energy could be used as a universal equivalent in the condition of the absence of a double coincidence of desires. The explanation of this lies in that everyone needs energy, and trust in money should be absolute and independent of institutions, equipment, technology. That is why a more perfect general equivalent is needed, which would be based on absolute values and their unconditional value. Energy could be such a universal commodity, equivalent, and means. It could solve the problem of lack of double coincidence of desires as a common equivalent. We can give up certain resources or products that result from our activities today and exchange them for energy that we can use to purchase goods or services later. The value of energy will not be lost. A striking example of the devaluation of money and the energy basis compared to modern money is the situation in the early 1920s in the Weimar Republic during hyperinflation. At that time, the cost of burning money for heating was higher than the purchasing power it provided: in some places, firewood was more expensive than a block of cash.

This paper emphasizes the direct and indirect connection between money and energy. We accumulated information on the role of energy in money circulation and the energy basis of money, but, as highlighted above, significant issues need to be addressed regarding the public recognition of energy as money at this stage. And while trust in energy is absolute, it will be impossible to convince people and shift institutions to energy circulation as a general equivalent until the subject is evaluated and researched to a greater extent than has been the case so far.

Of course, value stability should be studied in dynamics and quantitatively. A separate study should be devoted to this issue to explore the possibility of using energy as a general equivalent in modern socio-economic relations. Further studies of volatility analysis are consistent with the study of new forms of money in the 4th Industrial Revolution (Avgouleas, Blair, 2020, p. 6), which casts doubt that assets with high volatility are unlikely to function as money. Therefore, unambiguous conclusions also require quantitative research on this issue. An important area of further research will be the practical and technological implementation of payments in terms of the energy concept of money and accounting for transactions.

Funding

This research received no external funding.

Acknowledgments

The author is grateful to the referees for helpful comments on earlier versions of this paper.

Conflicts of Interest

The author declares no conflict of interest.

References

1. *10 Facebook statistics every marketer should know in 2021 [infographic]*. Retrieved from: https://www.oberlo.com/blog/facebook-statistics, 5.10.2021.
2. Aglietta, M., Ponsot, J.F., Ould-Ammed, P. (2016). *La Monnaie, entre Dettes et Souveraineté*. Paris: Odile Jacob.
3. Ahlers et al. (2010). *How Green is Our Green? A Sustainability Assessment of U.S. and Australian Currency*. Retrieved from: https://www.uvm.edu/~shali/currency.pdf, 10.11.2021.
4. Alpanda, S., Peralta-Alva, A. (2010). Oil crisis, energy-saving technological change and the stock market crash of 1973-74. *Review of Economic Dynamics, Vol. 13, Iss. 4*, pp. 824-842, doi: 10.1016/j.red.2010.04.003.
5. Ambrosio-Albala, P. et al. (2020). From rational to relational: How energy poor households engage with the British retail energy market. *Energy Research & Social Science, No. 70, 101765*, doi: 10.1016/j.erss.2020.101765.
6. Andal, E.G.T. (2022). Industrialisation, state-related institutions, and the speed of energy substitution: The case in Europe. *Energy, No. 239, Part C, 122274*. doi: 10.1016/j.energy.2021.122274.

7. Ante, L., Fiedler, I., Strehle, E. (2021). The impact of transparent money flows: Effects of stablecoin transfers on the returns and trading volume of Bitcoin. *Technological Forecasting and Social Change, No. 170, 120851*, doi: 10.1016/j.techfore.2021.120851.
8. Ante, L., Steinmetz, F., Fiedler, I. (2021). Blockchain and energy: A bibliometric analysis and review. *Renewable and Sustainable Energy Reviews, No. 137, 110597*, doi: 10.1016/j.rser.2020.110597.
9. Arasu, B.S., Seelan, B.J.B., Thamaraiselvan, N. (2020). A machine learning-based approach to enhancing social media marketing. *Computers & Electrical Engineering, No. 86, 106723*, doi: 10.1016/j.compeleceng.2020.106723.
10. Avgouleas, E., Blair, W. (2020). The concept of money in the 4th industrial revolution - a legal and economic analysis. *Singapore Journal of Legal Studies*, pp. 4-34.
11. Ayres, R.U. et al. (2013). Sustainability transition and economic growth enigma: Money or energy? *Environmental Innovation and Societal Transitions*, *No. 9*, pp. 8-12, doi: 10.1016/j.eist.2013.09.002.
12. Azarenkova, G.M., Samorodov, B.V., Melnychenko, O.V. (2014). Monitoring of bank activity indicators for increasing its credit capacity. *Actual Problems of Economics, Vol. 162, Iss. 12*, pp. 356-3681.
13. Baron, J., Millhauser, J. (2021). A place for archaeology in the study of money, finance, and debt. *Journal of Anthropological Archaeology*, *No. 62*, *101278*, doi: 10.1016/j.jaa.2021.101278.
14. Bask, A., Rajahonka, M. (2017). The role of environmental sustainability in the freight transport mode choice. *International Journal of Physical Distribution & Logistics Management, Vol. 47, Iss. 7*, 560-602, doi: 10.1108/ijpdlm-03-2017-0127.
15. Beermann, J. (2020). Back to the roots: cash and its core functions. In: *Cash in the age of payment diversity*. International Cash Conference 2019. Frankfurt am Main: Deutsche Bundesbank.
16. Bejarano, H., Gillet, J., Rodriguez-Lara, I. (2021). Trust and trustworthiness after negative random shocks. *Journal of Economic Psychology*, *No. 86, 102422*, doi: 10.1016/j.joep.2021.102422.
17. Bliss, S. (2021). Labor, energy, and ecosocialist futures. *Political Geography*, *No. 89, 102424*, doi: 10.1016/j.polgeo.2021.102424.
18. Bogachov, S., Kwilinski, A., Miethlich, B., Bartosova, V., Gurnak, A. (2020). Artificial Intelligence Components and Fuzzy Regula-tors in Entrepreneurship Development. *Entrepreneurship and Sustainability Issues*, *Vol. 8, Iss. 2*, pp. 487-499, doi: 10.9770/jesi.2020.8.2(29).
19. Borgonovo, E., Caselli, S., Cillo, A., Masciandaro, D., Rabitti, G. (2021). Money, privacy, anonymity: What do experiments tell us? *Journal of Financial Stability*, *No. 56, 100934*, doi: 10.1016/j.jfs.2021.100934.

20. Brandl, B. (2020). Ist Blockchain das Ende der Banken? *Kölner Zeitschrift für Soziologie und Sozialpsychologie, No. 72,* pp. 543-565, doi: 10.1007/s11577-020-00716-w.
21. Buchanan, J.A., Roberts, G. (2021). Other people's money: Preferences for equality in groups. *European Journal of Political Economy, 102124,* doi: 10.1016/j.ejpoleco.2021.102124.
22. Burlaka, O. et al. (2019). Implementation and Legal Regulation of Electronic Insurance in Ukraine. *Journal of Legal, Ethical and Regulatory Issues, 22(SI2).*
23. Cabello, G.J. (2020). Money Leaks in Banking ATM's Cash-Management Systems. *Virtual Economics, Vol. 3, Iss. 2,* 25-42, doi: 10.34021/ve.2020.03.02(2).
24. Caferra, R., Colasante, A., Morone A. (2021). The less you burn, the more we earn: The role of social and political trust on energy-saving behaviour in Europe. *Energy Research & Social Science, No. 71, 101812,* doi: 10.1016/j.erss.2020.101812.
25. Caldentey, E.P. (2015). Money and generalized exchange: A critical look at Neo-Walrasian theory. Investigación Económica, *Vol. 74, Iss. 293,* pp. 39-67, doi: 10.1016/j.inveco.2015.10.003.
26. Card payments in Europe – current landscape and future prospects: a Eurosystem perspective. Retrieved from: https://www.ecb.europa.eu/pub/pubbydate/2019/html/ecb.cardpaymentsineu_currentlandscapeandfutureprospects201904~30d4de2fc4.en.html#toc1 15.12.2020.
27. Casertano, S. (2013). International oil companies in the post-studio era: Strategic responses of energy majors to the 2003-2008 price boom. *Energy Strategy Reviews, Vol. 1, Iss. 3,* pp. 211-217, doi: 10.1016/j.esr.2012.12.005.
28. Churchill, S.A., Smyth, R. (2020). Ethnic diversity, energy poverty and the mediating role of trust: Evidence from household panel data for Australia. *Energy Economics, No. 86, 104663,* doi: 10.1016/j.eneco.2020.104663.
29. Cunha, P.R., Melo, P., Sebastião, H. (2021). From Bitcoin to Central Bank Digital Currencies: Making Sense of the Digital Money Revolution. *Future Internet, Vol. 13, Iss. 7,* 165, doi: 10.3390/fi13070165.
30. Dalevska, N., Khobta, V., Kwilinski, A., Kravchenko, S. (2019). A model for estimating social and economic indicators of sustainable development. *Entrepreneurship and Sustainability Issues, Vol. 6, Iss. 4,* pp. 1839-1860, doi: 10.9770/jesi.2019.6.4(21).
31. D'Altroy, T.N., Earle, T.K. (1985). Staple finance, wealth finance and storage in the Inka political economy. *Curr. Anthropol., No. 26,* pp. 187-206.
32. Davies, G. (2016). *A History of Money: Fourth Edition*. Wales: University of Wales Press.
33. Davis, D., Korenok, O., Norman, P., Sultanum, B., Wright, R. (2020). Playing with money. *Journal of Economic Behavior & Organization, Vol. 200,* pp. 1221-1239, doi: 10.1016/j.jebo.2020.06.031.

34. Davis, J., Mengersen, K., Bennett, S. et al. (2014). Viewing systematic reviews and meta-analysis in social research through different lenses. *SpringerPlus*, *No. 3*, 511, doi: 10.1186/2193-1801-3-511.
35. De Filippi, P., Mannan, M. (2020). Reijers, W. Blockchain as a confidence machine: The problem of trust & challenges of governance. *Technology in Society*, *No. 62*, *101284*, doi: 10.1016/j.techsoc.2020.101284.
36. Dementyev, V.V., Kwilinski, A. (2020). Institutional Component of Production Costs. *Journal of Institutional Studies*, *No. 12*, pp. 100-116, doi: 10.17835/2076-6297.2020.12.1.100-116.
37. Dorian, J.P., Franssen, H.T., Simbeck, D.R. (2006). Global challenges in energy. *Energy Policy, Vol. 34, Iss. 15*, pp. 1984-1991, doi: 10.1016/j.enpol.2005.03.010.
38. Douthwaite Douthwaite, R. (2012). Degrowth and the supply of money in an energy-scarce world. *Ecological Economics*, *No. 84*, pp. 187-193, doi: 10.1016/j.ecolecon.2011.03.020.
39. Eeghen, P.-H. (2021). Funding money-creating banks: Cash funding, balance sheet funding and the moral hazard of currency elasticity. *International Review of Financial Analysis*, *No. 76*, *101736*, doi: 10.1016/j.irfa.2021.101736.
40. Eenmaa-Dimitrieva, H., Schmidt-Kessen, M.J. (2019). Creating markets in no-trust environments: The law and economics of smart contracts. *Computer Law & Security Review, Vol. 35, Iss. 1*, pp. 69-88, doi: 10.1016/j.clsr.2018.09.003.
41. European Central Bank (2012). *How much does it cost to make a payment?* Retrieved from: https://www.ecb.europa.eu/paym/groups/pdf/cogeps/121022/A_11_ECB_Cost_of_payments_study.pdf?f952dbf6849bf1babce0df7c95711601, 3.10.2021.
42. Figueroa, A., Molière, L., Pegels, A., Never, B., Kutzner, F. (2019). Show me (more than) the money! Assessing the social and psychological dimensions to energy efficient lighting in Kenya. *Energy Research & Social Science*, *No. 47*, pp. 224-232, doi: 10.1016/j.erss.2018.10.002.
43. Franzen, A., Mader, S. (2022). The Importance of Money Scale (IMS): A new instrument to measure the importance of material well-being. *Personality and Individual Differences*, *No. 184*, *111172*, doi: 10.1016/j.paid.2021.111172.
44. Friedman, B.M. (2001). Monetary Policy. In: N.J. Smelser, P.B. Baltes, *International Encyclopedia of the Social & Behavioral Sciences*. Pergamon.
45. Friedman, M. (1956). The quantity theory of money – a restatement. *Studies in the Quantity Theory of Money* (pp. 3-21). Chicago, IL: University of Chicago Press.
46. Galvin, R. (2020). What is money? And why it matters for social science in energy research. In: *Inequality and Energy. How Extremes of Wealth and Poverty in High Income Countries Affect CO2 Emissions and Access to Energy*. Academic Press. ISBN 978-0-12-817674-0, doi: 10.1016/B978-0-12-817674-0.00002-3.

47. Galvin, R. (2020). Yes, there is enough money to decarbonize the economies of high-income countries justly and sustainably. *Energy Research & Social Science, No. 70, 101739*, doi: 10.1016/j.erss.2020.101739.
48. Giannini, C. (1995). Money, trust, and central banking. *Journal of Economics and Business, Vol. 47, Iss. 2*, pp. 217-237, doi: 10.1016/0148-6195(94)00047-H.
49. Giri, F. (2021). The relationship between headline, core, and energy inflation: A wavelet investigation. *Economics Letters, 110214*, doi: 10.1016/j.econlet.2021.110214.
50. *Global digital population as of January 2021*. Retrieved from: https://www.statista.com/statistics/617136/digital-population-worldwide/, 5.10.2021.
51. Gordon, R., Brunson, M.W., Shindler, B. (2014). Acceptance, acceptability, and trust for sagebrush restoration options in the Great Basin: A longitudinal perspective. *Rangeland Ecology & Management, Vol. 67, Iss. 5*, pp. 573-583, doi: 10.2111/REM-D-13-00016.1.
52. Greenberg, M.R. (2014). Energy policy and research: The underappreciation of trust. *Energy Research & Social Science, No. 1*, pp. 152-160, doi: 10.1016/j.erss.2014.02.004.
53. Grossmann, K. et al. (2021). The critical role of trust in experiencing and coping with energy poverty: Evidence from across Europe. *Energy Research & Social Science, No. 76, 102064*, doi: 10.1016/j.erss.2021.102064.
54. Güntzer, M.M., Jungnickel, D., Leclerc, M. (1998). Efficient algorithms for the clearing of interbank payments. *European Journal of Operational Research, Vol. 106, Iss. 1*, pp. 212-219, doi: 10.1016/S0377-2217(97)00265-8.
55. Halkos, G.E., Gkampoura, E.-C. (2021). Evaluating the effect of economic crisis on energy poverty in Europe. Renewable and Sustainable Energy Reviews, *No. 144*, 110981, doi: 10.1016/j.rser.2021.110981.
56. Hatfield, J.M. (2018). *Social engineering in cybersecurity: The evolution of a concept. Computers & Security, No. 73*, pp. 102-113, doi: 10.1016/j.cose.2017.10.008.
57. Haug, E.G. (2020). The smallest possible money unit! When money crashes into the laws of physics. *Physica A: Statistical Mechanics and its Applications, No. 560*, 125143, doi: 10.1016/j.physa.2020.125143.
58. Hawlitschek, F., Notheisen, B., Teubner, T. (2020). A 2020 perspective on "The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy". *Electronic Commerce Research and Applications, No. 40, 100935*, doi: 10.1016/j.elerap.2020.100935.
59. Heaven, D. (2017). Remaking money. *New Scientist, Vol. 236, Iss. 3154*, pp. 37-39, doi: 10.1016/S0262-4079(17)32361-8.
60. Hendrickson, J.R., Luther, W.J. (2021). Cash, crime, and cryptocurrencies. *The Quarterly Review of Economics and Finance*, doi: 10.1016/j.qref.2021.01.004.
61. *HICP - inflation r*ate. Retrieved from: https://ec.europa.eu/eurostat/databrowser/view/tec00118/default/table?lang=en, 5.10.2021.

62. Hofmarcher, T. (2021). The effect of education on poverty: A European perspective. *Economics of Education Review*, *No. 83, 102124*, doi: 10.1016/j.econedurev.2021.102124.
63. *IEA. Data statis*tics. Retrieved from: https://www.iea.org/data-and-statistics, 2.11.2021.
64. Ingham, G. (1996). Money is a Social Relation. *Review of Social Economy, Vol. 54, Iss. 4,* pp. 507-529, doi: 10.1080/00346769600000031.
65. Ingham, G. (1996). The nature of money. *Economic Sociology: European Electronic Newsletter 2004, Vol. 5, Iss. 2*, pp. 18-28.
66. Ingham, G. (1998). On the Underdevelopment of the "Sociology of Money". *Acta Sociologica***,** *Vol. 41, Iss. 1*, pp. 3-18, doi: 10.1177/000169939804100101.
67. Jacobson, J., Gruzd, A., Hernández-García, Á. (2020). Social media marketing: Who is watching the watchers? *Journal of Retailing and Consumer Services, No. 53, 101774*, doi: 10.1016/j.jretconser.2019.03.001.
68. Jenkins, K. et al. (2016). Energy justice: A conceptual review. *Energy Research & Social Science, No. 11*, pp. 174-182, doi: 10.1016/j.erss.2015.10.004.
69. Jevons, W.S. (1875). *Money and the Mechanisms of Exchange*. New York: Appleton and Company.
70. Johnstone, P., McLeish, C. (2020). World wars and the age of oil: Exploring directionality in deep energy transitions. *Energy Research & Social Science, No. 69, 101732*, doi: 10.1016/j.erss.2020.101732.
71. Johnstone, P., McLeish, C. (2022). World wars and sociotechnical change in energy, food, and transport: A deep transitions perspective. *Technological Forecasting and Social Change, No. 174*, 121206, doi: 10.1016/j.techfore.2021.121206.
72. Kahn, C.M., Roberds, W. (2009). Why pay? An introduction to payments economics. *Journal of Financial Intermediation, Vol. 18, Iss. 1*, pp. 1-23, doi: 10.1016/j.jfi.2008.09.001.
73. Karekezi, S., Majoro, L. (2002). Improving modern energy services for Africa's urban poor. *Energy Policy, Vol. 30, Iss. 11-12*, pp. 1015-1028, doi: 10.1016/S0301-4215(02)00055-1.
74. Karpinska, L., Śmiech, S. (2020). Invisible energy poverty? Analysing housing costs in Central and Eastern Europe. *Energy Research & Social Science, No. 70, 101670*, doi: 10.1016/j.erss.2020.101670.
75. Kelman, H.C. (1958). Compliance, identification, and internalization: Three processes of attitude change? *Journal of Conflict Resolution, Vol. 2, Iss. 1*, pp. 51-60.
76. Keynes, J.M. (1930). *A treatise on money*. New York: Harcourt, Brace and Company.
77. Kharazishvili, Y. et al. (2021). The Systemic Approach for Estimating and Strategizing Energy Security: The Case of Ukraine. *Energies, No. 14, 2126*, doi: 10.3390/en14082126.
78. Kharazishvili, Y., Kwilinski, A., Grishnova, O., Dzwigol, H. (2020). Social Safety of Society for Developing Countries to Meet Sus-tainable Development Standards: Indicators, Level, Strategic Benchmarks (with Calculations Based on the Case Study of Ukraine). *Sustainability, Vol. 12, Iss. 21, 8953*, doi: 10.3390/su12218953.

79. Koibichuk, V., Ostrovska, N., Kashiyeva, F., Kwilinski, A. (2021). Innovation Technology and Cyber Frauds Risks of Neobanks: Gravity Model Analysis. *Marketing and Management of Innovations, No. 1*, pp. 253-265, doi: 10.21272/mmi.2021.1-19.
80. Korol, T. (2021). Examining Statistical Methods in Forecasting Financial Energy of Households in Poland and Taiwan. *Energies, No. 14, 1821*, doi: 10.3390/en14071821.
81. Kostyrko, R., Kosova, T., Kostyrko, L., Zaitseva, L., Melnychenko, O. (2021). Ukrainian Market of Electrical Energy: Reforming, Financing, Innovative Investment, Efficiency Analysis, and Audit. *Energies, No. 14, 5080*, doi: 10.3390/en14165080.
82. Kuzior, A., Kwilinski, A., Hroznyi, I. (2021). The Factorial-Reflexive Approach to Diagnosing the Executors' and Contractors' Attitude to Achieving the Objectives by Energy Supplying Companies. *Energies, No. 14, 2572*, doi: 10.3390/en14092572.
83. Kuzior, A., Kwilinski, A., Tkachenko, V. (2019). Sustainable Development of Organizations Based on the Combinatorial Model of Artificial Intelligence. *Entrepreneurship and Sustainability, Vol. 7, Iss. 2*, 1353-1376, doi: 10.9770/jesi.2019.7.2(39).
84. Kwilinski, A., Volynets, R., Berdnik, I., Holovko, M., Berzin, P. (2019). E-Commerce: Concept and Legal Regulation in Modern Economic Conditions. *Journal of Legal, Ethical and Regulatory Issues, No. 22(SI2)*, pp. 1-6.
85. Kwilinski, A., Vyshnevskyi, O., Dzwigol, H. (2020). Digitalization of the EU Economies and People at Risk of Poverty or Social Exclusion. *J. Risk Financial Manag., No.13*, 142, doi: 10.3390/jrfm13070142.
86. Lacker, J.M., Weinberg, J.A. (2003). Payment economics: studying the mechanics of exchange. *Journal of Monetary Economics, vol. 50, Iss. 2*, pp. 381-387, doi: 10.1016/S0304-3932(03)00006-0.
87. Lagoarde-Segot, T. (2020). Financing the Sustainable Development Goals. *Sustainability, No. 12, 2775*, doi: 10.3390/su12072775.
88. Lakhno, V. et al. (2018). Model of Managing of the Procedure of Mutual Financial Investing In Information Technologies and Smart City Systems. *International Journal of Civil Engineering and Technology, Vol. 9, Iss. 8*, pp. 1802-1812.
89. Larue, L. (2020). The Ecology of Money: A Critical Assessment. *Ecological Economics, No. 178, 106823*, doi: 10.1016/j.ecolecon.2020.106823.
90. Lashitew, A.A., van Tulder, R., Liasse, Y. (2019). Mobile phones for financial inclusion: What explains the diffusion of mobile money innovations? *Research Policy, Vol. 48, Iss. 5*, pp. 1201-1215, doi: 10.1016/j.respol.2018.12.010.
91. Lears, J. (1995). Playing with Money. *The Wilson Quarterly, Vol. 19, Iss. 4*, pp. 7-23.
92. Lee, K., Lee, B., Oh, W. (2015). Thumbs Up, Sales Up? The Contingent Effect of Facebook Likes on Sales Performance in Social Commerce. *Journal of Management Information Systems, Vol. 32, Iss. 4*, pp. 109-143, doi: 10.1080/07421222.2015.1138372.

93. Lekshmi, R.R. et al. (2018). Market Clearing Mechanism Considering Congestion under Deregulated Power System. *Procedia Computer Science, No. 143*, pp. 686-693, doi: 10.1016/j.procs.2018.10.447.
94. Levulytė, L., Šapkauskienė, A. (2021). Cryptocurrency in context of fiat money functions. *The Quarterly Review of Economics and Finance, No. 82*, pp. 44-54, doi: 10.1016/j.qref.2021.07.003.
95. Li, B., Wang, Y. (2020). Money creation within the macroeconomy: An integrated model of banking. *International Review of Financial Analysis, No. 71, 101547*, doi: 10.1016/j.irfa.2020.101547.
96. Li, T., Wang X., Ni, Y. (2020). Aligning social concerns with information system security: A fundamental ontology for social engineering. Information Systems. *Information Systems, Vol. 104, 101699*, doi: 10.1016/j.is.2020.101699.
97. Liu, L., Bouman, T., Perlaviciute, G., Steg, L. (2020). Effects of competence- and integrity-based trust on public acceptability of renewable energy projects in China and the Netherlands. *Journal of Environmental Psychology, No. 67*, 101390, doi: 10.1016/j.jenvp.2020.101390.
98. Lyulyov, O., et al. (2021). Comprehensive Assessment of Smart Grids: Is There a Universal Approach? *Energies, Vol. 14, Iss. 12*, 3497, doi: 10.3390/en14123497.
99. Lyulyov, O. et al. (2021). The Impact of the Government Policy on the Energy Efficient Gap: The Evidence from Ukraine. *Energies, No. 14*, 373, doi: 10.3390/en14020373.
100. Marx, K. (1911). *A Contribution to the Critique of Political Economy*. Chicago: Charles H. Kerr and Company.
101. Mayer, R.C., Davis, J.H., Schoorman, F.D. (1995). An integrative model of organizational trust. *Academy of Management Review, No. 20*, pp. 709-734, doi: 10.5465/amr.1995.9508080335.
102. McKillop, H. (2021). Salt as a commodity or money in the Classic Maya economy. *Journal of Anthropological Archaeology, No. 62*, 101277, doi: 10.1016/j.jaa.2021.101277.
103. Melnychenko, O., Hartinger, R. (2017). Role of blockchain technology in accounting and auditing. *European Cooperation, Vol. 9, No. 28*, pp. 27-34.
104. Melnychenko, O. (2013). Economic analysis tools of electronic money and transactions with it in banks. *Financial And Credit Activity: Problems Of Theory And Practice, Vol. 2, Iss. 15*, pp. 59-66, doi: 10.18371/fcaptp.v2i15.25006.
105. Melnychenko, O. (2020). Is Artificial Intelligence Ready to Assess an Enterprise's Financial Security? *J. Risk Financial Manag., No. 13,* 191, doi: 10.3390/jrfm13090191.
106. Melnychenko, O. (2021). Energy Losses Due to Imperfect Payment Infrastructure and Payment Instruments. *Energies, No. 14*, 8213, doi: 10.3390/en14248213.
107. Melnychenko, O. (2021). The Energy of Finance in Refining of Medical Surge Capacity. *Energies, No. 14*, 210, doi: 10.3390/en14010210.

108. Melnychenko, O., Kwiliński, A. (2017). Energy management: Analysis of the retrospective in the perspective context for economic development. *Eur. Coop., Vol. 7, No. 26*, pp. 66-80.
109. Mertens, T., Bruninx, K., Duerinck, J., Delarue, E. (2021). Capacity credit of storage in long-term planning models and capacity markets. *Electric Power Systems Research, No. 194*, 107070, doi: 10.1016/j.epsr.2021.107070.
110. Middlemiss, L., Gillard, R. (2015). Fuel poverty from the bottom-up: Characterising household energy vulnerability through the lived experience of the fuel poor. *Energy Research & Social Science, No. 6*, pp. 146-154, doi: 10.1016/j.erss.2015.02.001.
111. Mills, A.D., Rodriguez, P. (2020). A simple and fast algorithm for estimating the capacity credit of solar and storage. *Energy, No. 210*, 118587, doi: 10.1016/j.energy.2020.118587.
112. Mouton, F., Leenen, L., Venter, H. S. (2016). Social engineering attack examples, templates and scenarios. *Computers & Security, No. 59*, pp. 186-209, doi: 10.1016/j.cose.2016.03.004.
113. Munyegera, G.K., Matsumoto, T. (2016). Mobile Money, Remittances, and Household Welfare: Panel Evidence from Rural Uganda. *World Development, No. 79*, pp. 127-137, doi: 10.1016/j.worlddev.2015.11.006.
114. Nord, J.H., Nord, G.D. (1995). Mis research: Journal status assessment and analysis. *Inform. Manag., No. 29*, pp. 29-42, doi: 10.1016/0378-7206(95)00010-T.
115. Nussbaumer, P., Bazilian, M., Modi, V. (2012). Measuring energy poverty: Focusing on what matters. *Renewable and Sustainable Energy Reviews, Vol. 16, Iss. 1*, pp. 231-243, doi: 10.1016/j.rser.2011.07.150.
116. O'Dwyer, K.J., Malone, D. (2014). Bitcoin mining and its energy footprint. *IET Conf Publ*, pp. 280-285, doi: 10.1049/cp.2014.0699.
117. Oliveira, C.M.D., Albergaria De Mello Bandeira, R., Vasconcelos Goes, G., Schmitz Gonçalves, D.N., D'Agosto, M.D.A. (2017). Sustainable Vehicles-Based Alternatives in Last Mile Distribution of Urban Freight Transport: A Systematic Literature Review. *Sustainability, No. 9*, 1324. https://doi.org/10.3390/su9081324
118. Pająk, K., Kamińska, B., Kvilinskyi, O. (2016). Modern Trends of Financial Sector Development under the Virtual Regionalization Conditions. *Financial and Credit Activity: Problems of Theory and Practice, Vol. 2, Iss. 21*, pp. 204-217, doi: 10.18371/fcaptp.v2i21.91052
119. Pająk, K., Kvilinskyi, O., Fasiecka, O., Miskiewicz, R. (2017). Energy security in regional policy in Wielkopolska region of Poland. *Economics and Environment, Vol. 2, Iss. 61*, pp. 122-138.
120. Poortinga, W., Pidgeon, N. (2003). Exploring the dimensionality of trust in risk regulation. *Risk Analysis, No. 23*, pp. 961-972, doi: 10.1111/1539-6924.00373.

121. Prentice, D., Paluck, E.L. (2020). Engineering social change using social norms: lessons from the study of collective action. *Current Opinion in Psychology, No. 35*, pp. 138-142, doi: 10.1016/j.copsyc.2020.06.012.
122. *Preparing for the euro's digital future.* Retrieved from: https://www.ecb.europa.eu/press/blog/date/2021/html/ecb.blog210714~6bfc156386.en.html, 9.09.2021.
123. Przenajkowska, K., Polasik, M. (2018). Koszty gotówki i elektronicznych instrumentów płatniczych w Unii Europejskiej [Costs of cash and electronic payment instruments in the European Union]. *Ekonomiczne Problemy Usług [Economic Service Problems], Vol. 2, Iss. 131/1,* pp. 283-290, doi: 10.18276/epu.2018.131/2-28.
124. Przybylski, A.K., Murayama, K., De Haan, C.R., Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior, Vol. 29, Iss. 4*, pp. 1841-1848, doi: 10.1016/j.chb.2013.02.014.
125. Radecki, L.J. (1999). Banks' payments-driven revenues. *Federal Reserve Bank of New York Economic Policy Review, No. 5*, 53-70.
126. Rahman, M.H., Lee, G.H.Y., Shabnam, N., Jayasinghe, S. (2020). Weathering trust. *Journal of Economic Behavior & Organization, No. 178*, pp. 449-473, doi: 10.1016/j.jebo.2020.07.027.
127. Rahmatian, A. (2018). Money as a legally enforceable debt. *European Business Law Review, Vol. 29, Iss. 2*, pp 205-236.
128. Rakpho, P., Yamaka, W. (2021). The forecasting power of economic policy uncertainty for energy demand and supply. *Energy Reports, Vol. 7, Iss. 3*, pp. 338-343, doi: 10.1016/j.egyr.2021.06.059.
129. Rodriguez-Alvarez, A., Llorca, M., Jamasb, T. (2021). Alleviating energy poverty in Europe: Front-runners and laggards. *Energy Economics, No. 103*, 105575, doi: 10.1016/j.eneco.2021.105575.
130. Salo, J. (2017). Social media research in the industrial marketing field: Review of literature and future research directions. *Industrial Marketing Management, No. 66*, 115-129. doi: 10.1016/j.indmarman.2017.07.013.
131. Samid, G. (2015). Money: An Irreverent Analysis. In *Tethered Money. Managing Digital Currency Transactions*, 1-32, doi: 10.1016/B978-0-12-803477-4.00001-6.
132. Samorodov, B., Melnychenko, O., Koshcheeva, N. (2014). Assessment of the bank's electronic money using the method of hierarchies analysis. *Financial And Credit Activity: Problems Of Theory And Practice, Vol. 2, Iss. 17*, pp. 204-217, doi: 10.18371/fcaptp.v2i17.37323.
133. San-Akca, B., Sever, S. D., Yilmaz, S. (2020). Does natural gas fuel civil war? Rethinking energy security, international relations, and fossil-fuel conflict. *Energy Research & Social Science, No. 70*, 101690, doi: 10.1016/j.erss.2020.101690.

134. Sasakura, K. (2021). A macroeconomic theory of price determination. *Structural Change and Economic Dynamics, No. 59*, pp. 214-227, doi: 10.1016/j.strueco.2021.08.008.
135. Schmiedel, H., Kostova, G., Ruttenberg, W. (2012). The social and private costs of retail payment instruments: a European perspective. *ECB Occasional Paper, No. 137*. Retrieved from: https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp137.pdf, 3.10.2021.
136. Sedera, D., Lokuge, S., Atapattu, M., Gretzel, U. (2017). Likes—The key to my happiness: The moderating effect of social influence on travel experience. *Information & Management, Vol. 54, Iss. 6*, pp. 825-836, doi: 10.1016/j.im.2017.04.003.
137. Siegrist, M., Earle, T.C., Gutscher, H. (2003). Test of a Trust and Confidence Model in the Applied Context of Electromagnetic Field (EMF) Risks. *Risk Analysis, No. 23*, 705-715, doi: 10.1111/1539-6924.00349.
138. Singh, S. (1999). Electronic money: understanding its use to increase the effectiveness of policy. *Telecommunications Policy, Vol. 23, Iss. 10-11*, pp. 753-773, doi: 10.1016/S0308-5961(99)00051-8.
139. Smith, A. (1902). *The Wealth of Nations*. New York: P.F. Collier & Sons.
140. Sovacool, B.K. (2014). What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda. *Energy Research & Social Science, No. 1*, pp. 1-29, doi: 10.1016/j.erss.2014.02.003.
141. Stamos, A., Altsitsiadis, E., Dewitte, S. (2019). Investigating the effect of childhood socioeconomic background on interpersonal trust: Lower childhood socioeconomic status predicts lower levels of trust. *Personality and Individual Differences, No. 145*, pp. 19-25, doi: 10.1016/j.paid.2019.03.011.
142. Stefanos Tsigdinos, Panagiotis G. Tzouras, Efthimios Bakogiannis, Konstantinos Kepaptsoglou, Alexandros Nikitas (2022). The future urban road: A systematic literature review-enhanced Q-method study with experts. *Transportation Research, Part D: Transport and Environment, No. 102*, 103158, doi: 10.1016/j.trd.2021.103158.
143. Stegen, K.S. (2011). Deconstructing the "energy weapon": Russia's threat to Europe as case study. *Energy Policy, Vol. 39, Iss. 10*, pp. 6505-6513, doi: 10.1016/j.enpol.2011.07.051.
144. Sun, L., Qiu, J., Zhang, W., Meng, K., Yin, X., Dong, Z. (2020). Energy sharing strategy based on call auction trading: Energy bank system. *International Journal of Electrical Power & Energy Systems, No. 123*, 106320, doi: 10.1016/j.ijepes.2020.106320.
145. Svartzman, R., Dron, D., Espagne, E. (2019). From ecological macroeconomics to a theory of endogenous money for a finite planet. *Ecological Economics, No. 162*, pp. 108-120, doi: 10.1016/j.ecolecon.2019.04.018.
146. Tam, K.-P., Chan, H.-W. (2018). Generalized trust narrows the gap between environmental concern and pro-environmental behavior: Multilevel evidence. *Global Environmental Change, No. 48*, pp. 182-194, doi: 10.1016/j.gloenvcha.2017.12.001.

147. Teles, P., Uhlig, H., e Azevedo, J.V. (2016). Is Quantity Theory Still Alive? *The Economic Journal, Vol. 126, Iss. 591*, pp. 442-464, doi: 10.1111/ecoj.12336.
148. Terwel, B.W., Harinck, F., Ellemers, N., Daamen, D.D.L. (2009). Competence-based and integrity-based trust as predictors of acceptance of carbon dioxide capture and storage (CCS). *Risk Analysis, Vol. 29, Iss. 8*, pp. 1129-1140, doi: 10.1111/j.1539-6924.2009.01256.x.
149. Thacker, P.G. (2013). Personal Finance for the Radiology Resident: A Primer. *Journal of the American College of Radiology, No. 11*, pp. 205-208, doi: 10.1016/j.jacr.2013.09.005.
150. Thaler, R.H. (2015). *Misbehaving: The Making of Behavioral Economics*. New York: W.W. Norton
151. *The Eurosystem cash strategy and the role of cash*. Retrieved from: https://www.bundesbank.de/en/tasks/cash-management/the-eurosystem-cash-strategy, 5.10.2021.
152. Thielmann, I., Hilbig, B.E. (2015). Trust: An Integrative Review from a Person–Situation Perspective. *Review of General Psychology, Vol. 19, Iss. 3*, pp. 249-277, doi: 10.1037/gpr0000046.
153. Tkachenko, V., Kwilinski, A., Korystin, O., Svyrydiuk, N., Tkachenko, I. (2019). Assessment of Information Technologies Influence on Financial Security of Economy. *Journal of Security and Sustainability, Vol. 8, Iss. 3*, pp. 375-385. doi: 10.9770/jssi.2019.8.3(7).
154. Tobin, J. (2008). Money. In: S.F. Durlauf, L.E. Blume (Eds.), *New Palgrave Dictionary of Economics*. Basingstoke: Palgrave MacMillan.
155. Townsend, R.M. (1989). Currency and credit in a private information economy. *Journal of Political Economy, No. 97*, pp. 1323-1344.
156. Valdez, A.C., Kluge, J., Ziefle, M. (2018). Elitism, trust, opinion leadership and politics in social protests in Germany. *Energy Research & Social Science, No. 43*, pp. 132-143, doi: 10.1016/j.erss.2018.05.025.
157. Van Den Akker, O.R., van Assen, M.A., Van Vugt, M., Wicherts, J.M. (2020). Sex differences in trust and trustworthiness: A meta-analysis of the trust game and the gift-exchange game. *Journal of Economic Psychology, No. 81*, 102329, doi: 10.1016/j.joep.2020.102329.
158. Vatamanyuk-Zelinska, U., Melnychenko, O. (2020). The effectiveness of financial and economic regulation of land relations in the context of stimulating entrepreneurial activity in the regions of Ukraine. *Problems And Perspectives In Management, No. 18*, 11-27, doi: 10.21511/ppm.18(3).2020.02.
159. Vivoda, V. (2010). Evaluating energy security in the Asia-Pacific region: A novel methodological approach. *Energy Policy, Vol. 38, Iss. 9*, pp. 5258-5263, doi: 10.1016/j.enpol.2010.05.028.

160. Wang, Y., Meister, D.B., Gray, P.H. (2013). Social Influence and Knowledge Management Systems Use: Evidence from Panel Data. *MIS Quarterly, Vol. 37, Iss. 1*, pp. 299-313.
161. Weber, M. (1978). *Economy and Society*. Berkeley: University of California Press.
162. Werner, R.A. (2014). Can banks individually create money out of nothing? — The theories and the empirical evidence. *International Review of Financial Analysis, No. 36*, pp. 1-19. doi: 10.1016/j.irfa.2014.07.015.
163. Werner, R.A. (2016). A lost century in economics: Three theories of banking and the conclusive evidence. *International Review of Financial Analysis, No. 46*, pp. 361-379, doi: 10.1016/j.irfa.2015.08.014.
164. Williamson, S.D. (2003). Payments systems and monetary policy. *Journal of Monetary Economics, Vol. 50, Iss. 2*, pp. 475-495, doi: 10.1016/S0304-3932(03)00007-2.
165. Wray, L.R. (2004). *Credit and State Theories of Money: The Contributions of A, Mitchell Innes*. Cheltenham, UK: Edward Elger.
166. Yigitcanlar, T., Cugurullo, F. (2020). The Sustainability of Artificial Intelligence: An Urbanistic Viewpoint from the Lens of Smart and Sustainable Cities. *Sustainability, No. 12*, 8548, doi: 10.3390/su12208548.
167. Yip, J.A., Schweitzer, M.E. (2015). Trust promotes unethical behavior: excessive trust, opportunistic exploitation, and strategic exploitation. *Current Opinion in Psychology, No. 6*, pp. 216-220, doi: 10.1016/j.copsyc.2015.09.017.
168. Zawadzka, D., Strzelecka, A., Szafraniec-Siluta, E. (2021). Debt as a Source of Financial Energy of the Farm—What Causes the Use of External Capital in Financing Agricultural Activity? A Model Approach. *Energies, No. 14*, 4124, doi: 10.3390/en14144124.